

# Presentation and Outcome of Thoracic Injuries at a Tertiary Care Service Hospital

Pawan Sharma<sup>1</sup>, CK Jakhmola<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Surgery, Army College of Medical Sciences and Senior Advisor, (Surgery, Trauma and Surgical Critical Care) Base Hospital Delhi Cantt, New Delhi, India, <sup>2</sup>Professor and Head, Department of Surgery, Army College of Medical Sciences and Consultant (Surgery and GI Surgery), Base Hospital Delhi Cantt, New Delhi, India

## Abstract

**Introduction:** Thoracic injuries account for a substantial proportion of all injury-related admissions, morbidity, and mortality in all service hospitals. It directly accounts for almost one-fifth of deaths resulting from trauma. This study was conducted to analyze the presentation and outcome of thoracic injuries at a tertiary care service hospital.

**Materials and Methods:** It was a prospective observational study of all the patients of thoracic injuries who presented at our hospital over a period of 3 years. Morbidity and mortality rates were compared and analyzed along with management and outcome. Associated injuries were also recorded and analyzed.

**Results:** Thoracic injuries comprised 18.2% of all trauma admission and the mechanism was blunt in majority (89.1%) of cases. Vehicular accidents (62.2%) and assault were the most common modes of injury. Rib fracture was the most common chest injury seen in 214 out of the 314 patients while abdominal visceral injuries were the most common associated injuries in polytrauma. Associated extrathoracic injuries caused a higher mortality rate in contrast to an isolated chest injury. Majority of the patients were managed nonoperatively. Intercostal drainage tube insertion was the most common modality of treatment in 82% of the cases, whereas, thoracotomy was required only in 3.18% of the patients. Overall, mortality was 5.41%.

**Conclusion:** Thoracic injuries can be readily diagnosed in the emergency department and require simple surgical procedures in the majority to prevent immediate mortality and morbidity. Meticulous and repeated clinical evaluation of these patients is required to prevent further worsening and long-term complications.

**Key words:** Blunt, Penetrating thoracic injuries, Thoracic trauma, Thoracotomy

## INTRODUCTION

Thoracic or chest trauma is a major contributor of morbidity and mortality all across the globe. Interestingly, despite high morbidity and mortality, a significant proportion of these injuries are treatable, and consequent mortality is preventable. It is pertinent to note that barely 5–10% of patients with thoracic injuries require major operative intervention.<sup>[1,2]</sup> More than 90% of these patients can be managed successfully by simple bedside interventions such as needle thoracostomy or intercostal

drainage (ICD) tube insertion. Thoracic injuries are the second most common cause of mortality in pediatric population following an injury.<sup>[3,4]</sup> It is not easy to gauge the true proportion or overall burden of these injuries because of inadequate data in most of the developing countries including ours. Therefore, a comprehensive analysis and interpretation of these injuries are essential to predict the likely outcome. Keeping in view the above, the study was undertaken to assess and analyze the true presentation, pattern and outcome of these injuries.

## MATERIALS AND METHODS

This study was a retrospective analysis of all those patients at Base Hospital Delhi Cantt who reported over a period of 3 years from April 1, 2014, to March 31, 2017, with thoracic trauma. All patients with thoracic trauma who were admitted during the above mentioned time period

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**Corresponding Author:** Dr. Pawan Sharma, Department of Surgery, Trauma and Surgical Critical Care, Surgical Division, and ACMS, Base Hospital, Delhi Cantt, India. Phone: +91-8860602390. E-mail: drpawansharma55@gmail.com

and consented to be part of this study were included. All those cases who were either brought dead or suffered cardiac arrest on arrival were excluded. All included patients underwent a thorough clinical examination as per ATLS guidelines, and relevant imaging modalities were performed along with basic hematological and biochemical investigations as part of the detailed evaluation.<sup>[5]</sup> All these patients were followed up for a period of 30 days to study their survival, morbidity, and mortality.

Informed consent was sought from all the patients included in the study, and ethical clearance was obtained from the Institutional Ethical Committee.

The severity of the injuries was assessed using injury severity score or the ISS.

### Statistical Analysis

The entire data were analyzed statistically using SPSS 16.0 utilizing descriptive statistics such as mean, median, and mode. Multivariate analysis was used for the study outcomes. Qualitative data were analyzed with Chi-square test and the quantitative data with student *t*-test. A confidence interval of 95% along with  $P < 0.05$  was considered statistically significant.

## RESULTS

Thoracic injuries were present in 18.2% ( $n = 314$ ) of all trauma admissions during the entire study period. There was a clear male preponderance with a male to female ratio of 7:1 (275:39). The mean age at presentation was 32.80 years (range: 3–76 years). Majority of patients (84%,  $n = 264$ ) were young in 20–46 years of age group predominant mechanism of thoracic injury was road traffic accidents (RTA) in 62% ( $n = 195$ ) patients. Among patients of RTA, 45% ( $n = 88$ ) were consequent to two or three wheeler accidents, 30% ( $n = 59$ ) were related to 4 wheelers, and the remaining 25% ( $n = 48$ ) were pedestrian of hit and run injury patterns.

Thirty one cases, who were brought with a history of assault, presented with stab injuries with a knife or with other sharp objects, gunshot injuries and assault with heavy wooden or metal rods. Some of the other mechanisms were animal attacks and railway track related injuries. 10% ( $n = 31$ ) of the patients were received within a 1<sup>st</sup> h (the golden hour) following injury, and the majority of the remaining patients were brought within 12 h of injury.

Out of 314 patients, 82% ( $n = 257$ ) patients were hemodynamically stable on presentation, and 18% cases were clinically and hemodynamically unstable.

60% of the unstable patients became stable following initial fluids or blood resuscitation. Another 22% were transient responders, and 18% did not respond to the initial resuscitation. A large majority (62.2%) presented as polytrauma and the remaining had isolated thoracic chest injuries. Subcutaneous emphysema was one of the presenting features in 15% cases [Figure 1].

Single or multiple rib fractures were the most frequent injury either in isolation (42 cases) or accompanied with one of the thoracic or extrathoracic injuries. Hemothorax and pneumothorax followed next in frequency [Figure 2] whereas, cardiac and esophageal trauma was uncommon [Figure 1]. Needle thoracocentesis was performed in two cases of tension pneumothorax. Blunt cardiac injury was observed in four cases out of which two had pericardial effusion, who were managed with pericardiocentesis. Both these patients were discharged in a stable condition whereas another patient who suffered sternal fracture with a cardiac contusion and severe arrhythmias expired during resuscitation in ICU. The fourth one with cardiac contusion recovered uneventfully. Diaphragmatic injury was seen in six cases whereas esophageal injury was observed in two cases.

The severity of the injuries was assessed using injury severity score or the ISS that was  $16.63 \pm 6.65$  and a median ISS of 14. The mean ISS was found to be  $17.2 \pm 7.4$  in blunt thoracic injuries, whereas, in penetrating injuries group it was  $14.5 \pm 3.1$ . Overall, the mean new injury severity score or the NISS was  $18.31 \pm 8.53$  with a median of 20.

Intercostal drainage procedure was the most common surgical intervention performed in almost 82% of the patients of which 14% required bilateral ICD placement. The mean duration of keeping ICD *in situ* was 8.94 days with a median of 7 days (range: 2–34 days). 92% of the patients required ICDs whereas 98% of the pneumothoraces and 99% of the hemopneumothoraces required ICD tube thoracostomy. ICD was also inserted in 65% cases of pulmonary contusions. Elective tracheostomy was performed in view of prolonged ventilation or for tracheal injury in 18 patients. 32 (10.19%) case had to be shifted directly to OT for a single or multiple surgical procedures for either thoracic or other associated injuries. As many as 19% cases had to be shifted to ICU from ED following initial resuscitation and stabilization.

Lifesaving emergency thoracotomies were performed in 10 (3.18%) patients [Table 1]. Fiber optic bronchoscopy or video-assisted thoracic surgery was performed in five patients for a number of indications such as foreign body, mucus plug or blood clot removal from the tracheobronchial tree or thoracic cavity, and for diagnostic

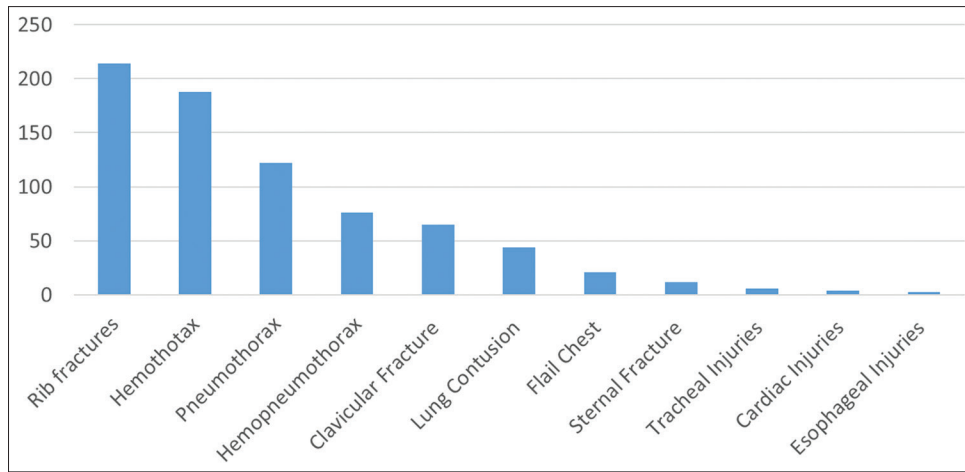


Figure 1: Pattern of thoracic injuries

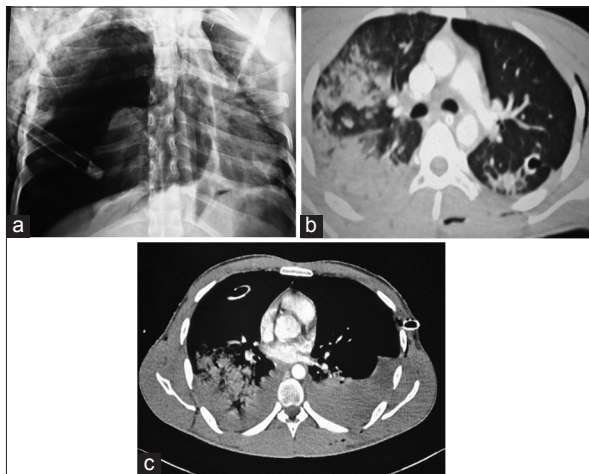


Figure 2: Clockwise from top left. (a) Chest X ray suggestive of right sided pneumothorax with lung collapse and ICD tube in situ, (b) CECT chest suggestive of lung contusion and laceration (right side) with pneumothorax and surgical emphysema (left side), (c) CECT chest showing bilateral hemothorax in a case of blunt thoracic trauma

Table 1: Indications for emergency thoracotomy

Indication	Number of patients
Lung laceration	2
Subclavian vessel injury	1
Penetrating chest injury	4
Diaphragmatic injury	3

and therapeutic approach for a possible diaphragmatic hernia following chest trauma. 45 (14.3%) of the patients received pain relief with thoracic epidural analgesia.

There were overall 16 (5.41%) deaths [Table 2]. The mortality was observed to be higher 5.8% ( $n = 14$ ) in blunt thoracic injuries as compared to penetrating injuries 2.8% ( $n = 1$ ). There were six deaths (37.5%) in elderly age group suggesting significantly higher mortality in that age

group. The number of deaths within 6 h of admission was 12% and within 24 h was 48%. The main cause of death in the early case was massive blood loss and significant associated injuries.

When morbidity was compared in both blunt and penetrating injury groups, it was found to be similar (14.3% and 14.7%). In all, 45 (14.3%) cases had one or more complications following chest trauma [Table 3].

The mean ICU stay was observed to be  $8.2 + 5.2$  days (range: 1–36 days) with a median of 7 days, whereas the mean hospital stay was  $14.09 \pm 8.10$  days (range: 1–62 days).

Although the morbidity in the blunt and penetrating trauma group was similar, the difference in the mortality figures was statistically significant [Table 4].

## DISCUSSION

Literature is full information on thoracic injuries, and a detailed search is suggestive of RTAs as the main cause of these injuries worldwide, more so in the developing world.<sup>[6-8]</sup> Our country accounts for as many as 6% of RTA burden of the world. In the present study also, vehicular accidents accounted for almost 62% of all thoracic injuries followed by assault (9.87%). This mechanism of injury is rarely reported in the western literature but is seen more often in developing countries such as ours and other Asian and African nations.

The rate of associated injuries (62.8%) in this study was comparable to that found in the literature. The chest injury was associated with extremity fracture in 16.85%, pelvic fracture in 8.90%, head injury in 7.15%, spinal injury in 9.85%, and maxillofacial trauma in 7.15%. In a study by Shorr *et al.*, they observed the incidence of associated

**Table 2: Cause of death (n=16)**

Cause of death	Percentage of patients
Hemorrhagic shock	2
Sepsis, MODS	3
Severe cardiac dysrhythmia	1
DIC	1
ARDS	5
Pulmonary thrombo embolism	1
Missed retroperitoneal injury	1
Severe head injury	2

ARDS: Acute respiratory distress syndrome

**Table 3: Morbidity (n=45)**

Complication	Incidence
VAP/pulmonary sepsis	7
LRTI/atelectasis	5
Retained hemothorax	6
ICD reinsertion	12
Wound infection	4
Empyema	2
Delayed pleural effusion	2
Persistent pneumothorax	1
AKI	3
DVT	1
Pressure ulcer	2

**Table 4: Outcome analysis (blunt and penetrating injury)**

Parameter	Blunt injury	Penetrating injury	P value
Mortality rate (%)	5.8	2.8	0.001
Injury severity score	17.2±7.4	14.5±3.1	NS
Hospital stay (days)	14.2	16.5	NS
Morbidity (%)	14.3	14.7	NS

injuries to the tune of 75%.<sup>[9]</sup> The most common associated injury was the abdominal trauma in 24.88% which is not the same as head injury, that is described as the most common associated injury in most of the studies.<sup>[6,10]</sup> Elisabeth *et al.* observed in a nationwide survey in the UK that the number of rib fractures and other associated injuries were related to morbidity and mortality in 27.8% of the blunt thoracic trauma cases.

A data review of 6332 patients from the trauma registry at university hospital San Antonio revealed that 27% patients of polytrauma and those with severe injuries (ISS >15) are more likely to sustain pulmonary contusion in blunt traumatic chest injury.<sup>[11]</sup>

In our study 59.8% patients had hemothorax, and as many as 63% had single or multiple rib fractures which are consistent with the existing data. 38% cases of hemothorax have been reported in an 11 years study by Al-Koudmani *et al.* in chest injury patients.<sup>[12]</sup> In our study, 24% of patients had hemopneumothorax. An overview of the

literature reveals that single or multiple fractures of the ribs are the most common thoracic injury, followed by lung contusions.<sup>[10,13]</sup>

Kulshrestha *et al.* observed that the cardiac injuries occur in 1.5–6% case of chest trauma.<sup>[14]</sup> In the current study, cardiac injuries were present in 1.27% patients. The mainstay of treatment in our study was nonoperative which is in accordance with other studies.<sup>[15-17]</sup> ICD insertion was the mainstay of management in as many as 82% of the patients. In one of the recent meta-analysis, it was observed that the use of prophylactic antibiotics reduces the risk of infective complications in traumatic chest injuries, mainly penetrating trauma.<sup>[18]</sup> Post-traumatic empyema has been variably reported from 2% to 25% and Staphylococcus aureus infection with complications as 35–75%.<sup>[19,20]</sup>

The requirement of mechanical ventilation (5.09%) and open thoracotomy (3.18%) in our study was similar to the previously published data.<sup>[6,10]</sup> In a study by Richardson, 5% of the patients of chest trauma required thoracotomy.<sup>[21]</sup> In a study by Locurto *et al.*, the average duration of the ICD tube was 4.5 days.<sup>[22]</sup> The same was observed to be 8.94 days in our study. Veysi *et al.* in their study found the mean ICU stay to be 4.5 days whereas the mean hospital stay and the mean ICU stay in our study was 14.09 days and 8.20 days, respectively.<sup>[6]</sup>

In another study by Shah and Solanki, 17% of patients having flail chest were treated with intermittent positive pressure ventilation.<sup>[23]</sup> There is wide variation in mortality figures among different authors ranging from 6.6% to 18.7%.<sup>[6,24]</sup> Acosta *et al.* observed the mortality rate to be 9.3% in their series with respiratory failure accounting for as high as 63.5% mortality.<sup>[25,26]</sup> Pearson *et al.* observed the morbidity figures to be 25.8% with atelectasis to be responsible in 14.6% cases.<sup>[10]</sup> Other significant causes of morbidity mentioned in literature include retained hemothorax, lung abscess and empyema that is reported to occur in 2–3% in various studies and ours it was 0.6%. Kumar *et al.* observed a mortality rate of 11.6%.<sup>[27]</sup> The overall morbidity in our study was 14.33%.

Massive blood loss leading to hemorrhagic shock continues to be the most common cause of immediate and early mortality in chest trauma in various studies.<sup>[6,26]</sup> In our study, the most common cause of mortality was acute respiratory distress syndrome (ARDS) and the overall in their study of 250 patients mortality was 5.41%. Lema *et al.* reported overall mortality to be 4.7% that is slightly lower than the previous studies.<sup>[28]</sup> Other authors have observed the mortality due to isolated chest trauma in the range of 4–8% and with the involvement of another system, it goes up to 13–15%, whereas in polytrauma, it is as high as

30–35%. Lee reports the figures to be 1.8% in blunt chest trauma.<sup>[28]</sup> Battle *et al.* describes the extremes of age, three or more rib fractures and other comorbid conditions to be responsible for increased mortality in blunt chest trauma.<sup>[29]</sup>

The foregoing observations reveal adequately that the presence of comorbidities, elderly age group, polytrauma and severity of injury result in higher morbidity and mortality in traumatic chest injury patients. They are also at additional risk of ARDS, and ventilator associated pneumonia especially in those who are on long-term ventilation. Serial physical examination can reduce the number of missed or occult injuries significantly in these patients.

## CONCLUSION

Thoracic injuries are a common occurrence and are major cause of morbidity and mortality in trauma victims. Since vehicular accident accounts for almost 60% of thoracic injuries, there is an immediate need to enforce strict traffic discipline and to educate the society to follow the laid down traffic rules and regulations to prevent these serious and life-threatening injuries. The aim of this study was to reiterate and highlight the fact that majority of the chest trauma is treatable with simple procedures and thoracotomy is rarely indicated. Furthermore, the vast majority of complications and the potential mortality is preventable. Timely intervention and referral to appropriate centers can add to the overall survival and better quality of life of these patients.

## REFERENCES

- LoCicero J 3<sup>rd</sup>, Mattox KL. Epidemiology of chest trauma. *Surg Clin North Am* 1989;69:15-9.
- Tai NR, Boffard KD. Thoracic trauma: Principles of early management. *J Trauma* 2003;5:123-36.
- Burrington JD, LoCicero J, Mattox KL. Epidemiology of chest trauma. *Surg Clin North Am* 1989;69:15-9.
- Burrington JD. Chest injuries in children. *Can J Surg* 1984;27:466-9.
- ATLS Subcommittee, American College of Surgeons' Committee on Trauma, International ATLS working group. Advanced trauma life support (ATLS®): The ninth edition. *J Trauma Acute Care Surg* 2013;74:1363-6.
- Veysi VT, Nikolaou VS, Paliobeis C, Efsthathopoulos N, Giannoudis PV. Prevalence of chest trauma, associated injuries and mortality-a level I trauma centre experience. *Int Orthop* 2009;33:1429-33.
- Seamon MJ, Haut ER, Van Arendonk K, Barbosa RR, Chiu WC, Dente CJ, *et al.* An evidence-based approach to patient selection for emergency department thoracotomy: A practice management guideline from the eastern association for the surgery of trauma. *J Trauma Acute Care Surg* 2015;79:159-73.
- El-Menyar A, Abdelrahman H, Al-Hassani A. Clinical presentation and time-based mortality in patients with chest injuries associated with road traffic accidents. *Arch Trauma Res* 2016;5:e31888.
- Shorr RM, Crittenden M, Indeck M, Hartunian SL, Rodriguez A. Blunt thoracic trauma-analysis of 515 patients. *Ann Surg* 1987;206:200.
- Pearson FG, Joel O, Deslauriers CJ, Patterson A, Cooper JD. *Thoracic Surgery*. 2<sup>nd</sup> ed. Philadelphia, PA: Churchill Livingstone; 2002.
- Cohn SM, Dubose JJ. Pulmonary contusion-an update on recent advances in clinical management. *World J Surg* 2010;34:1959-70.
- Al-Koudmani I, Darwish B, Al-Kateb K, Taifour Y. Chest trauma experience over eleven-year period at al-mouassat university teaching hospital-Damascus: A retrospective review of 888 cases. *J Cardiothorac Surg* 2012;7:35.
- Unsworth A, Curtis K, Asha SE. Treatments for blunt chest trauma and their impact on patient outcomes and health service delivery. *Scand J Trauma Resusc Emerg Med* 2015;23:17.
- Kulshrestha P, Iyer KS, Das B, Balram A, Kumar AS, Sharma ML, *et al.* Chest injuries: A clinical and autopsy profile. *J Trauma* 1988;28:844-7.
- Kan CD, Yang YJ. Traumatic aortic and mitral valve injury following blunt chest injury with a variable clinical course. *Heart* 2005;91:568-70.
- Banning AP, Pillai R. Non-penetrating cardiac and aortic trauma. *Heart* 1997;78:226-9.
- Symbas PJ, Horsley WS, Symbas PN. Rupture of the ascending aorta caused by blunt trauma. *Ann Thorac Surg* 1998;66:113-7.
- Heydari MB, Hessami MA, Setayeshi K, Sajadifar F. Use of prophylactic antibiotics following tube thoracostomy for blunt chest trauma in the prevention of empyema and pneumonia. *J Inj Violence Res* 2014;6:91-2.
- Burton PR, Lee M, Bailey M, Pick AW. What causes post-traumatic empyema? *Emerg Med Australas* 2009;21:153-9.
- Kuo CH, Chen IC, Lin SS. Effects of the emergency trauma training course on the confidence of final-year medical students dealing with trauma patients. *Kaohsiung J Med Sci* 2010;26:45-9.
- Richardson JD. Indication for thoracostomy in thoracic trauma. *Curr Surg* 1985;42:361-64.
- Locurto JJ Jr., Tischler CD, Swan KG, Rocko JM, Blackwood JM, Griffin CC, *et al.* Tube thoracostomy and trauma-antibiotics or not? *J Trauma* 1986;26:1067-72.
- Shah JV, Solanki MI. Analytic study of chest injury. *IJSS J Surg* 2015;1:5-8.
- Hanafi M, Al-Sarraf N, Sharaf H. Pattern and presentation of blunt chest trauma among different age groups. *Asian Cardiovasc Thorac Ann* 2011;19:48-51.
- Morley EJ, Johnson S, Leibner E, Shahid J. Emergency department evaluation and management of blunt chest and lung trauma (trauma CME). *Emerg Med Pract* 2016;18:1-20.
- Acosta JA, Yang JC, Winchell RJ, Simons RK, Fortlage DA, Hollingsworth-Fridlund P, *et al.* Lethal injuries and time to death in a level I trauma center. *J Am Coll Surg* 1998;186:528-33.
- Kumar S, Gupta HO, Pandey A, Kumar A, Ahmad A, Kumar M, *et al.* Thoracic trauma trends in Northern India-single center experience. *Indian J Thoracic Cardiovasc Surg* 2013;29:167-70.
- Lema MK, Chalya PL, Mabula JB, Mahalu W. Pattern and outcome of chest injuries at Bugando medical centre in North Western Tanzania. *J Cardiothorac Surg* 2011;6:7.
- Battle CE, Hutchings H, Evans PA. Risk factors that predict mortality in patients with blunt chest wall trauma: A systematic review and meta-analysis. *Injury* 2012;43:8-17.

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